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The English compound stress myth¹

Heinz J. Giegerich

Abstract

This study investigates the distribution of end-stress and fore-stress among English NN and NNN compounds. It finds that end-stress in NNs is not ‘exceptional’, as many researchers have claimed, but confined to a reasonably well defined class of attribute-head NNs within which it is (at least optionally) grammatical and often predictable. In NNNs–NNs with embedded NNs–both fore-stress and end-stress can occur in both the embedding and the embedded NN, giving rise to eight possible stress patterns, all of which are attested. Moreover, the distribution of fore-stress and end-stress in embedding and embedded NNs follows the regularities identified in free-standing NNs. There is therefore no reason to accept the generalization whereby in NNNs, the second element is always stressed under right-branching and the first element under left-branching. While such patterns are perhaps particularly frequent, all others are also grammatical: the Compound Stress Rule known in the literature for some fifty years, deriving stress patterns from structural geometry, is wrong.

1 Introduction: the myth

Generalizations about English compound and phrasal stress have attracted interest for many years, not only in their own right but also for showcasing various aspects of phonological theory, dating back at least to the American Structuralist tradition. Trager & Smith (1951) used them in a demonstration of a numerical representation of stress levels. Generative Phonology (Chomsky & Halle 1968: 15 ff., 91 ff.; Halle & Keyser 1971: 15 ff.) noted the property of the Compound and Nuclear Stress Rules whereby component stress-patterns are preserved when embedded in larger constructions, and held up this property as a prime example of cyclic rule application, a device that was to be central to Generative methodology for years to come.

Later still, in *Metrical Phonology*–Lieberman & Prince (1977: 257), but predated by Rischel (1972)–the same generalizations were to figure with similar enthusiasm

in arguments for non-numerical stress representation, and indeed for non-cyclic rule application:

- (1) (a) Compound Stress Rule ('CSR'):

In any pair of sister nodes $[AB]_L$, where L is a lexical category, B is strong iff it branches.
- (b) Nuclear Stress Rule ('NSR'):

In any pair of sister nodes $[AB]_P$, where P is a phrasal category, B is strong.

And Hayes (1981) argued that Liberman & Prince's CSR supported his theory of extrametricality, while Liberman & Sproat (1992: 147) at least regarded the predictions made by the formalism of the day as 'fairly well verified', a claim then also endorsed – if more cautiously: see section 3.2 below – by Kvam (1990) and by Kösling & Plag's (2009) recent study of relevant corpus evidence.

The specifics of Generative and Metrical rule formalisms are no longer at issue, nor is it of interest here whether stress preservation effects really motivate cyclicity (Collie 2007), or some notational variant thereof (Halle & Vergnaud 1987). What is of interest is that all theories' versions of the rules in question predict the compound stress patterns presented in (2) below, and only those. And not only the generalizations but in some cases even the examples themselves have been handed down from author to author, from theory to theory, from the research literature to textbook treatments such as Giegerich (1992) and Plag (2003).

- (2) (a) $\acute{N}N$

radio station
community centre
labour party
- (b) $[\acute{N}N]N$

radio station manager
oil-tanker driver
kitchen towel rack ('rack for kitchen towels')
- (c) $N[\acute{N}N]$

government working party
university funding council
kitchen towel rack ('towel rack in the kitchen')

For phrases, (1b) uniformly predicts stress on the right-hand element² as in (3a) below. This pattern is also noted by some authors (e.g. Halle & Keyser 1971: 21; Zwicky 1986; Giegerich 1992: 257 f.; Plag 2003: 137 ff.) as occurring with certain 'exceptional' compounds, exemplified in (3b):

- (3) (a) blue book
black board
elementary proposal
- (b) Madison Road
apple pie
Pennsylvania Station

Note that Liberman & Prince's (1977) use of *iff* ('if and only if') rather than just *if* in the CSR, (1a) above, rules out point-blank the existence of end-stressed compounds such as (3b). For them, such forms must be noun phrases rather than compounds.

Liberman & Prince's (1977) formulation of the CSR gave rise to the further, strikingly elegant claim that the prominence relations holding among the elements of for example compound nouns are accounted for by the very same rule (therefore re-named 'Lexical Category Prominence Rule') as are those holding, on a lower prosodic level, within the metrical structure of non-compound nouns: compare the primary stress on branching right feet in *sèmolina*, *èxecútion* and the secondary stress on non-right-branching *nìghtingàle*. So, all prominence relations within a noun, compound or simple, are assigned by the same rule.

Moreover, like the exceptional compounds not recognised by Liberman & Prince (1977), (3b) above, non-compound nouns may sometimes, and clearly exceptionally (Giegerich 2004: 6), have stress on a non-branching right-hand element – *bàmbóo*, *kàngaróo* and the like. So, in the vein of Liberman & Prince (1977) but going further than that account, even the exceptions to the basic generalization show parallel patterns. And a further suggestion of a possible link between prominence and right-branching is provided by syllable weight differentiation: heavy ('bimoraic') syllables, favoured sites of word stress in many languages including English, are syllables with branching rhymes. Onsets, left daughters of the syllable node, never participate in the mora count however complex they may be.

So, the generalizations expressed by the patterns in (2) and (3) are both well-established in the phonological literature and of value in a number of ways to phonological theory, apparently forming part of a larger, intriguing, yet poorly understood generalization whereby at least in English, right-branching is linked with prominence whereas left-branching is not.

I shall argue in this paper that the generalizations exemplified by the patterns in (2) and (3), and with them the central characteristics of Liberman & Prince's (1977) CSR, are wrong on most counts. In particular I hope to show the following.

First, bipartite noun-plus-noun compounds (henceforth 'NNs') may have fore-stress or end-stress. There is nothing inexplicable about the examples in (3b) above; their 'exceptional' nature in Generative and Metrical Phonology was merely an artefact of a theory in its time unable to express their defining characteristics.

Second, tripartite forms ('NNNs') – NNs containing NNs as either their right or their left daughters – may have fore-stress or end-stress in both the embedding and the embedded NN. The patterns exemplified in (2b,c) above are therefore not the only ones possible but two out of a possible eight, all of which can be demonstrated to exist.

I deal with these two points in the following sections.

2 End-stressed NNs – compound or phrase?

2.1 Flaws in the background

End-stressed NNs exist: recall (3b) above. The real issue is whether such forms can actually be compounds despite their stress pattern, or whether they are simply noun

phrases. The latter position was taken by Bloomfield (1933: 228), who famously argued that *ice cream*, with a variable stress pattern, is a phrase for some speakers and a compound for others. I show below and elsewhere (Giegerich 2004) that within a certain class of NNs, stress variation especially across dialects is extremely common, so that for Bloomfield, a particular construction type may in some dialects be phrasal and in others lexical. This position is not *a priori* unreasonable; but it is compromised by an observation first made by Lees (1963: 120; see also Ladd 1984) whereby within the same dialect, *Madison Avenue*, *apple pie* have end-stress while *Madison Street*, *apple cake* – forms of identical syntactic behaviour and near-identical semantics – have fore-stress. It makes little sense to say the former are members of the category NP and the latter of N. It does make sense to say it is possible for compounds to have end-stress (Olsen 2000; Giegerich 2004).

The position opposite to Bloomfield's – whereby NN forms such as those in (3b) are not phrases but compounds which have 'exceptional' end-stress – may have been encouraged by a simplistic assumption in early Generative Grammar (surviving in some recent treatments, but not for example in Radford (1988) and Payne & Huddleston (2002)) whereby in the syntax, nouns cannot pre-modify nouns. All NNs must then be compounds.

The combination of a modifier noun and a head noun is referred to as a COMPOUND NOUN and is not treated as a phrasal constituent at all [...]. (Burton-Roberts 1997:163; similarly Olsen 2000).

That too is wrong. If *wooden bridge* is a phrase, as it certainly is, then so is *steel bridge* (Giegerich 2004: 7f.). Adjective-forming *-en* denoting 'made of' is fossilized and attaches to perhaps two nouns now – *wood* and *wool* – and with metaphorical senses to a few more: *silken voice* vs. *silk shirt*, similarly *gold(en)*, *lead(en)*. The derivational morphology does not make a productive process available to supply this kind of adjective (Marchand 1969: 270). Nor does it procure denominal adjectives denoting 'place of origin' other than 'country' – hence adjectival modifiers in *American car*, *British student* and noun modifiers in *London fog*, *Edinburgh tram*. Again, it makes very little sense to say the former are phrases and the latter have to be compounds just because nouns cannot be phrasal modifiers. It does make sense to say certain NNs may be phrases.³

The reason why end-stressed compounds had to be treated as inexplicable exceptions in Generative Phonology – and see here especially comments by Schmerling (1976) and Zwicky (1986) – was that in that framework, the phonological component of the grammar interpreted a very simple syntactic surface structure, without access to any other, e.g. semantic, information (Chomsky 1965; Chomsky & Halle 1968). Crucially, that surface structure would not express the argument-predicate relationship present for example in fore-stressed *match-maker* but absent in end-stressed *town crier*: the two forms would have identical surface structures. It was for that lack of formally accessible information that the theory was essentially unable to predict NN stress patterns: compounds have fore-stress except when they have end-stress. It would have been equally possible – and, given phrasal end-stress, perhaps even desirable under Occam's

Razor – to regard fore-stress among some compounds as ‘exceptional’ and end-stress as the norm across the board.

So, given that compounds may have end-stress, and that NNs may be phrases, it follows that in principle, end-stressed NNs may be of either phrasal or lexical (compound) status – a position long held in the mainstream of the Anglist literature: Koziol (1937), Jespersen (1942), Faiß (1981), Bauer (1978, but see Bauer (1998) for a modified position), Giegerich (2004), Plag (2006), Plag *et al.* (2008). This means that in the case of end-stressed NNs, criteria other than stress have to be invoked to determine whether they are compounds or phrases. I return to those when the distinction becomes relevant; for the moment it is not.

2.2 End-stressed NNs

I want to argue in this section that there is a specific subclass of NN forms which straddles the compound–phrase divide. Both fore-stress and end-stress may occur in this subclass; and while this is the only kind of right-headed NN in which the latter is possible, its occurrence does not necessarily signal phrasal status. On the semantic side, such forms are characterized by a relationship of either ascriptive or associative attribution between the two Ns, though often their semantic detail is not fully derivable from the lexical semantics of their parts. On the syntactic side, they may be analyzable into two separate domains by syntactic processes such as the *Pro-one* operation, or they may not be.

The subclass of NNs under consideration here excludes NNs displaying an argument–predicate relationship, for example ‘synthetic compounds’ such as *match-maker*, *dog owner* etc. (but not *town crier*). Such forms have to be compounds as the relevant argument structure cannot occur in syntactic attribute–head forms. Notably, they invariably have fore-stress (Lieberman & Sproat 1992),⁴ as do exocentric compounds such as *red-neck*, *hatchback* etc. Again, the semantics of such forms is alien to NP. Nor are we concerned here with fossilized left-headed constructions such as *court martial*, *procurator fiscal* and *chicken Kiev*. Rather, we are concerned with the NN versions of the two basic types of attribute–head relationship exemplified with adjectival attributes in (4a,b) respectively:

- (4) (a) beautiful picture
 blue book
 small elephant
 nervous person
- (b) financial advisor
 avian influenza
 vernal equinox
 nervous disorder

Attribution in (4a) is ascriptive, ascribing to the head the property denoted by the adjective. Clearly this is the unmarked type of adjectival attribution. In contrast, (4b) exemplifies associative attribution: here, the adjective does not denote a property

but – surprisingly for adjectives – an entity associated with the head (Levi 1978, Ferris 1993, Payne and Huddleston 2002). Thus, *financial advisor* is ‘advisor associated with finance’, *avian influenza* ‘influenza associated with birds’, *vernal equinox* ‘equinox associated with spring’ *nervous disorder* ‘disorder associated with nerves’. Giegerich (2005, 2009) argues that for various reasons, associative attribution typically (but not always) occurs in lexical adjective-noun combinations while ascriptive attribution is usually associated with the syntax, although again not invariably so.

Unsurprisingly, many such associative (entity-denoting) adjectives have ascriptive counterparts (e.g. *nervous* in (4a)); and most have noun synonyms, so that the associative relationship is also displayed by the NNs in (5b). (5a) gives some examples of ascriptive NNs; *dvandvas* (Bauer 2008) are a subclass of NNs displaying ascription.

- (5) (a) singer-songwriter
 fighter-bomber
 steel bridge
 corn oil
 toy train
 (b) finance advisor
 bird ‘flu
 spring equinox
 nerve disorder

There is no single rule for any dialect of English that might determine the distribution of the two available stress patterns within NNs such as those in (5), a distribution which is moreover subject to considerable dialect variation (and for that reason not recorded in (5)). In Scottish English, most of these examples would have end-stress. Nor is this subclass of NNs sharply delineated. But I shall here propose the following generalizations. Firstly, as we have already seen, the end-stress pattern occurs only in NNs displaying a straightforward attribute-head relationship. Secondly, end-stress favours transparent over non-transparent semantics. And thirdly, end-stress favours ascriptive over associative attribution. In other words, the more phrase-like a given right-headed NN is, the more likely it is to have the stress pattern typically associated with phrases. I deal with these three points in turn.

Fudge (1984: 144 ff.) and similarly Kingdon (1959: 149 ff.) note that end-stress is likely in NNs whose first element denotes time, place or material. Examples are given in (6):

- (6) (a) summer fruit
 morning coffee
 November rain
 Sunday timetable
 (b) town crier
 London fog
 garden shed
 university exam

- (c) steel bridge
stone wall
cotton dress
meat pie

This kind of attribution may in many cases – e.g. in (6c) – be regarded as ascriptive; certainly it is semantically straightforward and transparent, in the sense that the meaning can be comprehensively inferred from the attribute-head relationship and the meanings of its participants. Fruit associated with summer can be straightforwardly inferred to be fruit that grows in summer. Nevertheless, similar examples may have fore-stress:

- (7) olive oil
peanut oil
thistle oil
avocado oil
corn oil

Again, dialect variation is rife among such forms – most would have end-stress in Scottish English; and for many non-Scottish speakers *olive oil* might be the only example in (7) to have end-stress. In contrast note the invariable fore-stress in *baby oil*, *engine oil*, with associative attribution.

It is no coincidence that *leatherjacket* and *silver-fish*, both insects, have fore-stress while their transparent counterparts denoting garments and fish, where meaning can be inferred, are end-stressed. End-stress favours transparent semantics. Similarly the forms in (8a) below, where the contribution of ‘milk’ to the form’s meaning is not transparent and the meaning of the whole cannot be inferred, unsurprisingly have fore-stress.

- (8) milk-boy
milk-fever
milk-tooth
milk-weed
milk-float

Note, however, that end-stress does not absolutely require full transparency. End-stressed *village shop* does not just denote a shop in a village, as one may infer, but in addition implies a certain range of merchandise. And not every house in the country is a *country house*, just as not every house in a town is a *town house*. So, end-stressed forms may not be fully transparent; and fore-stressed forms such as *thistle oil* may be no less transparent than *olive oil*, which the same speaker may end-stress. It seems simply to be the case that, if such NNs are lexicalized as denoting for example particular architectural forms or culinary ingredients then they may or may not adopt fore-stress. The specific reasons why this may happen to a given forms remain unclear. They may be prosodic, such that fore-stressed *town house* might fit a single foot while *country house* would not if it acquired fore-stress. Or they may be semantic, as Ladd (1984) implies when he

observes that of all the possible street names involving for example *Madison* – *Madison Road*, *Madison Avenue*, *Madison Place*,... – only the least marked *street*, in *Madison Street*, has fore-stress. Similarly, pastry names ending in *cake* such as *Christmas Cake*, less marked as a pastry name than *flan*, *tart*, *pie*, *pudding* have fore-stress. (See also Lees 1963). Transparency clearly is not a variable here.

Consider finally the following stress doublets, first noted by Faiß (1981):

- (9) toy factory
- steel warehouse
- metal separator
- hair net
- woman doctor
- glass case

In doublets of this kind, the end-stressed versions show straightforward ascriptive and the fore-stressed versions more complex associative attribution, which often involves argument-predicate relationships. It may well be the case that the end-stressed versions are simply phrasal, but this does not have to be the case.

What is clear and uncontroversial is that the fore-stressed versions of such doublets, and indeed fore-stressed NNs in general, are compounds. Associative attribution makes available for specific lexicalization an unlimited range of non-inferable meanings (see e.g. Downing 1977, Fanselow 1981: 156 ff., Olsen 2000, Adams 2001: 82 ff.), such that in (8) a boy is associated with milk in that he delivers it, a weed is associated with milk in that its sap resembles it, etc. Associative attribution simply has more room for specific, non-inferable (and in that sense non-transparent) interpretations than ascriptive attribution has.

Decisive criteria for phrasal status would be absolute semantic transparency, as well as the separate availability of the individual Ns to syntactic operations such as *pro-one* (Stirling & Huddleston 2002, Giegerich 2009). Hence, the compound status of *watch-maker* is confirmed by the ungrammaticality of **a clock-maker and a watch one*, and the phrasal status of *steel bridge* by the grammaticality of *a wooden bridge and a steel one*. Under this criterion, the end-stressed variants of (9) are indeed phrasal. But there is no reason to believe that all end-stressed NNs allow *pro-one* and hence have phrasal status on syntactic grounds. And, as we saw, the semantic criterion of transparency does not necessarily correlate with a given form's behaviour regarding stress; nor can we expect it to correlate with *pro-one*.

To summarize, it is clearly the case that a more phrase-like NN is more likely to display end-stress than is one whose internal semantic structure is alien to phrasal attribution. But there are no grounds for the claim that all end-stressed NNs are phrases (Bloomfield 1933; Marchand 1969; Liberman & Prince 1977; Liberman & Sproat 1992); nor is there reason to regard end-stressed compounds as 'exceptions' to a stress generalization about compounds in general. End-stress is simply one of two possible stress patterns available to certain NN compounds. Indeed, as we saw, in street and pastry names fore-stress may be regarded as the exception. I turn now to the second part of the English compound stress myth.

3. The stress patterns of NNNs

3.1. The myth and the facts

Here I assess the claim, expressed in Liberman & Prince's (1977) CSR given in (1) above, whereby the stress patterns of the two possible NNN constructions – NNs with NNs embedded either on the right or on the left, N[NN] and [NN]N respectively – are determined by structural geometry. A right-branching structure is said to stress the second element while a non-right-branching structure stresses the first: *kitchen* [tówel rack] vs. [kitchen tomel] rack. Recall further examples of this kind in (2b,c) above.

It is of course clear that such stress patterns for NNNs exist: examples such as those in (2), as well as others cited in the literature from Chomsky & Halle (1968) to Liberman & Prince (1977) and Liberman & Sproat (1992), are compelling. Similarly, in the first empirical investigation of its kind, Kösling & Plag (2009) find that in the Boston University Radio Speech Corpus, the majority of NNNs overall conform with the CSR's predictions, although the CSR is also violated in a substantial number of cases. For example among [NN]N forms, end-stress is found to be quite common (*living room táble*). Sproat (1994) regards such forms as phrases containing NN attributes; whether this is a true explanation or one that is entirely circular depends on whether such forms can also be shown to be phrases on semantic and syntactic grounds, as we have seen.

I want to argue in this section that despite the existence – and indeed the relatively high frequency – of the two NNN stress patterns predicted by the CSR, the generalization expressed by the CSR is a myth, simply because the other six possible patterns also exist. An NNN is an NN with an embedded NN. Either of the two NNs can have either end-stress or fore-stress, giving four combinatory possibilities for each of N[NN] and [NN]N. I will show that NNNs exemplifying each of these eight patterns can be found, and notably that not only end-stressed forms can contain fore-stressed forms as one may expect, given the more general expectation of more phrase-like patterns on the periphery of a construction, but also that fore-stressed NNs can contain end-stressed NNs. The two stress relations occurring in each NNN are largely independent of each other, and individually driven by the criteria discussed in section 2.2 above. Examples of each pattern are given in (10);⁵ the two sets predicted by the CSR are shaded.

The first point to be made about the NNNs displayed in (10) is that in each case, the stress patterns associated with both the embedded and the embedding NN follow the regularities described in 2.2 above.

Firstly, the embedded NN in each case has the same stress pattern as it would have in isolation. *Working party*, *sand-stone* as well as all other embedded NNs in (10a) are fore-stressed whether embedded or not. *Spring term* and *garden shed* as well as all other embedded NNs in (10bi) are end-stressed; in (10bii), the possible adoption of fore-stress by those and other NNs under embedding – *spring term séminar* – is due to Iambic Reversal (Liberman & Prince 1977) and therefore itself entirely regular. No other forms in (10) meet the structural description that triggers Iambic Reversal; all preserve their stress pattern under embedding.

(10)		(i) N[NN]	(ii) [NN]N
(a) <i>End-stress, embedded fore-stress</i>		gòvernment wórking party mòrning commúter train stèel wàre-house kìtchen tówel rack	sànd-stone wáll dèsk-top pùblishing lìving-room fúrniture bèet-root stéw
(b) <i>End-stress, embedded end-stress</i>		univèrsity spring térm alumínium garden shéd plàstic toy tráin drèam family cár	spring term séminar gàrden shed róof sùmmer fruit púdding còuntry house gárden
(c) <i>Fore-stress, embedded fore-stress</i>		ówl nèst-box gráin stòre-room stèel wàre-house tomáto grèen-house ⁶	éngine-oil wàste óil-tanker driver kítchen towel ràck stóre-room mànager
(d) <i>Fore-stress, embedded end-stress</i>		cóoking olive òil dessért ice-crèam sìde fruit sàlad héating brown còal	garden shéd exhibition model ráilway enthusiàst toy cár collection government commíttee member

Secondly, the embedding NN in each case has the same stress pattern as it would have if it were not embedding. Thus, the embedding stress pattern in *government working party* is the same as that in *government party* or *government committee*. Compare similarly *sand-stone wall* and *stone wall*, *university spring term* and *university term*, *garden shed roof* and *shed roof* etc. So, whatever the regularities are that distribute fore-stress and end-stress among NNs, they operate independently in the two NNs contained in every NNN and determine that NNN's overall stress pattern.

3.2 Analysis 1: all end-stressed NNs are phrases

Reconsider now an analysis, rejected in section 2.2 above, which treats all end-stressed NNs indiscriminately and as a matter of principle as phrases. Would such an analysis, proposed by Bloomfield (1933) and implied without discussion by Liberman & Prince (1977), save Liberman & Prince's CSR in the sense that it would separately – presumably through NSR, (1b) above – account for those patterns that CSR fails to predict? As we shall see, it would account for only some of those patterns, and not without creating major new problems in addition to the one already identified in section 2.2 above but here momentarily ignored for the sake of the argument – namely that on non-phonological grounds, some end-stressed NNs simply cannot be phrases but must be regarded as compound nouns.

Under this analysis, all of (10bi) and (10bii) would be phrases containing embedded phrasal NNs. Moreover, end-stressed *sand-stone wall* etc. (10aii) would be treated as phrases in which a head noun is modified by an NN compound; similarly, and notably, *government working party* etc. (10ai) should be analyzed as phrases with NN compound heads. This, however, would entirely remove the motivation for having the ‘right-strong-iff-branching’ clause, and with it the entire role of tree geometry, in the CSR, giving rise instead to a simpler CSR under which all compound NNs are simply fore-stressed regardless of branching. This in turn would legitimize the stress pattern of *owl nest-box* etc. (10ci), which Liberman & Prince’s CSR fails to predict, as well as agreeing with Liberman & Prince on the stress pattern of *engine-oil waste* etc. (10cii).

Apart from the surprising fact that this analysis, whose central assumption is shared by Liberman & Prince (1977), does not serve to maintain Liberman & Prince’s branching-sensitive CSR but instead destroys it, this is a promising result where accounting for the patterns attested in (10) is concerned. However, the analysis runs into trouble when attempting to deal with end-stressed NNs embedded in fore-stressed NNs (10d). Under Botha’s (1983) ‘No Phrase Constraint’ and the more general ‘Lexical Integrity Principle’ (Lapointe 1980; Di Sciullo & Williams 1987; Scalise & Guevara 2005), syntactic phrases cannot be embedded in compound words. No NNN whose embedded NN has end-stress can be a compound if, as this analysis assumes, its embedded NN is a phrase.

Forms such as those in (10di) appear to be exceedingly rare. They are possible only where the embedded, end-stressed form shows clear signs of lexicalization, thereby corroborating the Lexical Integrity Principle but contradicting the phrasal analysis of end-stressed NNs pursued in this section. *Olive oil*, as we saw in section 2.2, is for many speakers the only culinary oil term to have end-stress: if fore-stressed *corn oil*, *peanut oil* etc. are compounds then surely so is *olive oil*. Note that *cooking corn oil* would share the stress pattern of *owl nest-box* (10ci). *Fruit salad* similarly sits alongside salads which are fore-stressed (Schmerling 1971), and moreover varies like *olive oil* and *ice cream*. Adjective-plus-noun *brown coal* is a specific kind of soft coal (‘lignite’); under a phrasal interpretation (‘coal which is brown’) this tripartite form would clearly be ill-formed. And in any case, if the end-stressed NNs embedded in (10di) were simply phrases then we should expect a much freer distribution.

Curiously, forms of the type (10dii), *garden shed exhibition* etc., appear to be more readily available although these, too, are ill-formed under Lexical Integrity if their embedded, end-stressed NNs are phrases. These forms are the NNN equivalents of a well-studied class of compounds which contain adjective-plus-noun phrases:

- (11) lexical integrity principle
 open door policy
 affordable housing policy
 severe weather warning
 cold weather payment
 sexually transmitted disease clinic

There is widespread consensus in the literature (Carstairs-McCarthy 2002, 2005; Giegerich 2009; Wiese 1996) that the phrases contained in such forms are to a greater or lesser extent lexicalized, similarly to the embedded forms in apparent bracketing paradoxes such as *baroque flautist*: just as Spencer (1988) pointed out that *baroque flute* is lexical (compare *wooden flute* in **wooden flautist*), Carstairs-McCarthy (2002: 82) argues that phrases embedded in forms such as those in (11) are lexicalized or at least clichés. The embedded end-stressed NNs in (10dii) must then be of the same status (unless the Lexical Integrity Principle, which enforces this analysis, is itself flawed). This raises the question, once again, of what precisely is meant by lexicalization, but here is not the place to go into this.

What is clear from this discussion is that Analysis 1, treating all end-stressed NNs as phrases, has the following consequences.

First, Liberman & Prince's CSR loses all reference to tree geometry: this discussion has exposed a fatal contradiction in Liberman & Prince's (1977) account, which, as we saw above, actually shares the assumption made here in Analysis 1 (but not elsewhere in this paper) that all end-stressed NNs are phrases.

Second, as we saw in section 2.2, if non-phonological criteria are invoked to draw the compound-phrase distinction then not all end-stressed NNs can be phrases: recall the compound nature of *country house* (which also occurs as an embedded NN in (10bii)). It is wrong, then, to subject this form, and possibly others, to stress rule that is specific to phrasal units.

Third, the NNNs in (10d) remain unpredicted as long as we accept the Lexical Integrity Principle. And if we do not accept Lexical Integrity then – apart from missing major generalization elsewhere in the grammar: see e.g. Scalise & Guevara (2005) – we fail to account for the rarity of cases such as (10di), assuming instead (clearly wrongly) that phrasal units can freely occur inside compound words.

Analysis 1 is not viable, then. Bloomfield was wrong.

3.3 Analyses 2 and 3: all NNs are or may be compounds

Now reconsider an analysis, also rejected above, whereby all NNs are compounds. If like Liberman & Prince (1977) we also deny the possibility of end-stress among NN compounds then of course Liberman & Prince's (1977) CSR accounts for the examples in the two shaded boxes (10ai,cii) only, wrongly predicting the stress patterns in the other six boxes to be ungrammatical for various reasons: (10aii,bi,bii) because they are end-stressed but being NNs cannot be phrases, (10di,dii) because they contain such end-stressed NNs, (10ci) because the right-hand element branches without being stressed.

But we know already from section 2.1 above that for different reasons, an analysis treating all NNs as compounds cannot sustain the CSR in the form proposed by Liberman & Prince: NNs may be end-stressed while not behaving like phrases in non-phonological terms. This is of course why many analysts of that era allowed for 'exceptional' end-stressed compounds of the *Madison Road* type. So let us express the possibility of end-stressed compounds in a revised CSR, perhaps by changing the *iff* ('if and only if') in the CSR (1a) to *if* ('if but not only if'). This would allow the right-hand element of an NN to be strong either if it branches or if it does not branch; and a

non-branching right-hand element would be weak. But a branching right-hand element could not be weak. In whatever way the old exception feature were to be encoded, it would allow ‘exceptional’ end-stress but not ‘exceptional’ fore-stress. This would leave (10ci,di) unaccounted for.

Moreover, like Analysis 1, Analysis 2 does not allow there to be a CSR based on structural geometry. In particular, the criterion of right-branching for cases such as *government working party* (10ai) is falsified by the presence of cases such as *owl nest-box* (10ci). Compare similarly *university spring term* (10bi) and *cooking olive oil* (10di), *sand-stone wall* (10bii) and *engine-oil waste* (10cii), *garden shed roof* (10bi) and *garden shed exhibition* (10dii). These stress contrasts are clearly not driven by tree geometry; what determines them is the regularities described in section 2.2.

Here is Analysis 3. Recall that our initial reasons for the dismissal of Analysis 2 in section 2.1 did not relate to stress. Rather, the argument was that on non-stress grounds, many end-stressed NNs are clearly compounds while others must be phrases. If *wooden bridge* is a phrase then so is end-stressed *steel bridge*. We also noted that end-stressed forms such as *steel bridge* are often analyzable by the syntax, such that for example *a wooden bridge and a steel one* is well-formed. So, subject entirely to criteria other than stress, end-stressed NNs may be compounds or phrases, if that distinction can be reliably drawn in all cases at all (which it probably cannot: Bauer (1998)). This means that any one of the boxes in (10a,b) above may contain both embedding phrases and embedding compounds; certainly none of those stress patterns can be deemed to be restricted to phrases, or to compounds. Note that row (10c) has no end-stress and is hence irrelevant here; and for (10d) we have already established compound status on the grounds of Lexical Integrity.

This in turn means that Analysis 3, more subtle in its treatment of end-stressed NNs than Analysis 1 (‘all phrases’) and Analysis 2 (‘all compounds’), does not improve the fate of Liberman & Prince’s CSR either. In whatever way we draw the compound–phrase distinction on phonological or non-phonological grounds, in the light of the facts in (10) Liberman & Prince’s CSR will not work. There is no CSR based on structural geometry.

It does seem to be the case that the patterns predicted by the CSR are particularly frequent: Kösling & Plag’s (2009) corpus sample shows this quite clearly. But this fact tells us nothing about the grammaticality of the other six patterns, however rare some of those may be. To simply call them ‘exceptions to the CSR’ would be to imply that they are not only rare but also in some sense formally defective, or irregular. As I showed above, they are not. A speaker who fore-stresses *side salad* but end-stresses *fruit salad* will also say *side fruit salad*. The occasion to do so may just not arise very often.

4 Conclusion

Expressed in a framework such as that of Liberman & Prince (1977), English has two CSRs for NNs:

- (12) a. In any pair of sister nodes $[AB]_N$, A is strong.
- b. In any pair of sister nodes $[AB]_N$, B is strong.

Without drawing up exact structural descriptions for these two rules, I showed in section 2.2 above that their distribution is far from random, and that it is driven by the nature of the dependent-head relationship in a given NN: straight attribution favours (12b) while an argument-predicate relationship requires (12a). This not only means that the CSR accepted in the literature for the past fifty or so years is wrong; it also means that an attractive generalization noted by Liberman & Prince (1977) about a link between right-branching and prominence within lexical constructions is an illusion: I noted the apparent parallelism between *government working party* and *sèmolína*, in section 1. But this is not surprising. The real parallelism is actually more interesting than the illusory one in that it goes further.

As is well-known, the Germanic subset of English nouns is characterized by fore-stress, with stress-neutral suffixation. Fore-stressed nouns such as *re-fit*, *driverlessness* etc. are clearly paralleled at compound level by fore-stressed *nest-box*, *owl nest-box* or indeed longer forms, not here discussed, such as *barn-owl nest-box* or *barn-owl nest-box manufacturer*.

Among the non-Germanic vocabulary, there is the set highlighted by Liberman & Prince (1977) – *semolína* and *government wórking party* – but there is also, as I noted in section 1, a set of nouns which are end-stressed without being right-branching: *bàmbóo*, *kàngaróo* and the like. These are paralleled by *country hóuse* as well as the various end-stressed NNNs documented in (10). What is interesting about end-stressed non-compound nouns is that diachronically they have tended to abandon their end-stress in favour of fore-stress: this happened long ago to French loans such as *virtue* (end-stressed in Chaucer, like many other such words), and is underway in forms such as *magazine*. The same tendency appears to be at work in end-stressed NNs, where lexicalization and the (possibly diachronic) adoption of fore-stress seem to go together, if in ways not fully understood. While there is no discernable difference in behaviour between compounds with Germanic and non-Germanic elements, both the stress patterns and the diachronic tendencies within the language's etymological mix of nouns are paralleled in the stress mess of compound nouns.

Notes

1. Earlier versions of this paper were presented at the Free University of Berlin and at the University of Vigo in autumn 2008. I am grateful to both audiences for their insightful comments. Discussion with Ingo Plag has as ever been lively and fruitful. Two reviewers for this journal have further helped me get this complex material into focus, and to correct at least one major oversight; I hope any remaining ones are minor.
2. I will henceforth refer to the stress pattern in (2a) as 'fore-stress' and to that in (3) as 'end-stress'.
3. Some such apparent nouns may in fact not just behave like adjectives but actually be adjectives. For a speaker who accepts *this bridge is steel*, *steel* will be an adjective in that construction as well as in *steel bridge*.
4. For discussion of some apparent exceptions – end-stressed *Tory leader*, *world leader* etc. – see Giegerich (2004).

5. Each of the examples in (10) has been verified with at least three speakers of Southern British Standard English. Many (and notably all those in (10di)) were also heard, with the stress patterns documented here, on BBC Radio 4.
6. Is *green* in *green-house* an adjective or a noun? ‘House for greens’? In any case, this (or the fact that *brown* in *brown coal* below clearly *is* an adjective) does not seem to impact on the stress pattern here.

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